

(12) INTERNATIONAL PUBLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
13 May 2004 (13.05.2004)

PCT

(10) International Publication Number
WO 2004/039482 A2

(51) International Patent Classification⁷: **B01F 3/00**

(21) International Application Number:
PCT/CA2003/001651

(22) International Filing Date: 30 October 2003 (30.10.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/422,490 31 October 2002 (31.10.2002) US

(71) Applicant and

(72) Inventor: GLASSFORD, Craig, L. [CA/CA]: 121
Phillips Drive, New Maryland, New Brunswick E3C 1E6
(CA).

(74) Agent: ANDERSON, J., Wayne; P.O. Box 1266, Station
B, Ottawa, Ontario K1P 5R3 (CA).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZW.

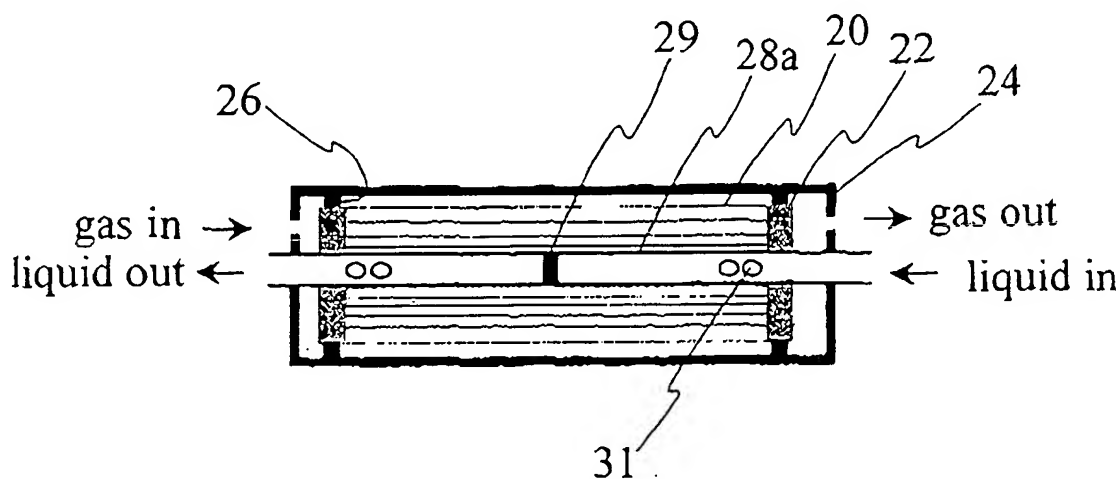
(84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CONTROLLED ATMOSPHERE GAS INFUSION



(57) Abstract: The invention disclosed relates to a method and apparatus for controlling the dissolved gas content of an aqueous liquid containing a dissolved gas by providing a microporous hydrophobic hollow fibre membrane, to provide at equilibrium a stable interface between an aqueous liquid phase containing dissolved gas on one side of the membrane and a gaseous phase on the other side of the membrane, and controlling the aqueous phase and gaseous phase pressures, such that in operation the gaseous phase pressure is up to but not exceeding the aqueous phase pressure, and flowing the gaseous and liquid phases across the membrane, to provide simultaneous mass transfer through the membrane of a first gas in the gaseous phase into the liquid phase and of a second gas dissolved in the aqueous liquid into the gaseous phase, whereby the gas content of the first gas in the aqueous phase is increased, the gas content of the second gas in the gaseous phase is decreased and the total dissolved gas pressure (TG) of the aqueous phase is altered.

WO 2004/039482 A2

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
13 May 2004 (13.05.2004)

PCT

(10) International Publication Number
WO 2004/039482 A3

(51) International Patent Classification⁷: **C02F 3/20,**
B01F 3/04

(21) International Application Number:
PCT/CA2003/001651

(22) International Filing Date: 30 October 2003 (30.10.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/422,490 31 October 2002 (31.10.2002) US

CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK,
LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX,
MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD,
SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG,
US, UZ, VC, VN, YU, ZW.

(84) Designated States (regional): ARIPO patent (BW, GH,
GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE,
SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicant and
(72) Inventor: GLASSFORD, Craig, L. [CA/CA]; 121
Phillips Drive, New Maryland, New Brunswick E3C 1E6
(CA).

Published:
— with international search report

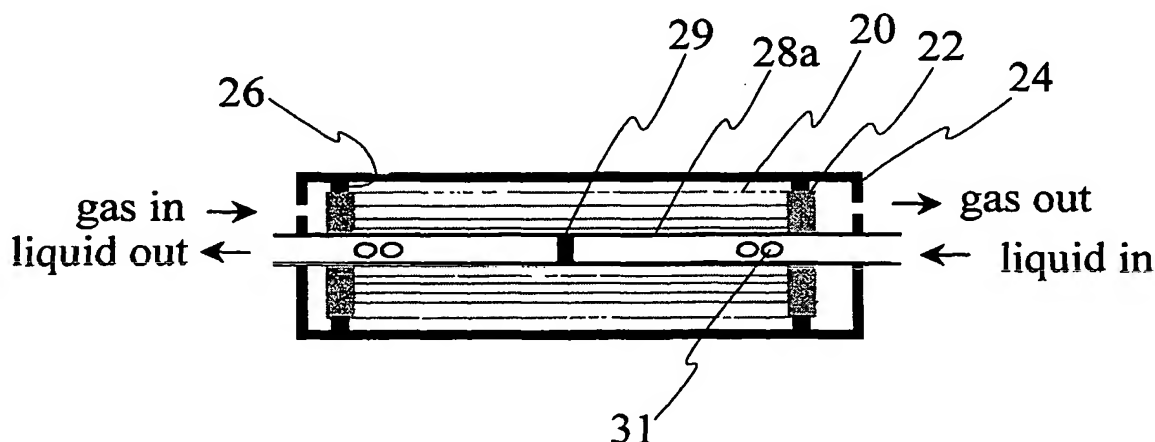
(74) Agent: ANDERSON, J., Wayne; P.O. Box 1266, Station
B, Ottawa, Ontario K1P 5R3 (CA).

(88) Date of publication of the international search report:
29 July 2004

(81) Designated States (national): AE, AG, AL, AM, AT, AU,
AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR,

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: CONTROLLED ATMOSPHERE GAS INFUSION



(57) Abstract: The invention disclosed relates to a method and apparatus for controlling the dissolved gas content of an aqueous liquid containing a dissolved gas by providing a microporous hydrophobic hollow fibre membrane, to provide at equilibrium a stable interface between an aqueous liquid phase containing dissolved gas on one side of the membrane and a gaseous phase on the other side of the membrane, and controlling the aqueous phase and gaseous phase pressures, such that in operation the gaseous phase pressure is up to but not exceeding the aqueous phase pressure, and flowing the gaseous and liquid phases across the membrane, to provide simultaneous mass transfer through the membrane of a first gas in the gaseous phase into the liquid phase and of a second gas dissolved in the aqueous liquid into the gaseous phase, whereby the gas content of the first gas in the aqueous phase is increased, the gas content of the second gas in the gaseous phase is decreased and the total dissolved gas pressure(TG) of the aqueous phase is altered.

WO 2004/039482 A3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/CA 03/01651

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C02F3/20 B01F3/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C02F B01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB 2 025 256 A (MITSUBISHI RAYON CO., LTD.) 23 January 1980 (1980-01-23) page 4, lines 3-21, 71-78; claims; figures	1-14
Y	US 6 209 855 B1 (C.L. GLASSFORD) 3 April 2001 (2001-04-03) cited in the application claims; figures	1-14
Y	PATENT ABSTRACTS OF JAPAN vol. 0130, no. 69 (C-569), 16 February 1989 (1989-02-16) & JP 63 258605 A (DAINIPPON INK & CHEM INC), 26 October 1988 (1988-10-26) abstract	1-14

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

Date of the actual completion of the international search

23 April 2004

Date of mailing of the international search report

03/05/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Cordero Alvarez, M

INTERNATIONAL SEARCH REPORT

Int. Application No
PCT/CA 03/01651

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	T.AHMED ET AL: "use of transverse flow hollow fibers for bubbleless membrane aeration" WAT.RES., vol. 30, no. 2, 1996, pages 440-446, XP0004035072 the whole document	1,9
A	T.AHMED ET AL: "use of sealed end hollow fibers for bubbleless membrane aeration: experimental studies" JOURNAL OF MEMBRANE SCIENCE, vol. 69, no. 1, 24 April 1992 (1992-04-24), pages 1-10, XP0000299373 AMSTERDAM,NL the whole document	1,9
A	EP 0 732 142 A (PERMEA, INC.) 18 September 1996 (1996-09-18) page 4, lines 23-51 - page 5, columns 10-16; claims; figures 10-13	1,5,9,11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/CA 03/01651

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
GB 2025256	A	23-01-1980	JP	55119102 U	23-08-1980
			JP	55001816 A	09-01-1980
			FR	2428456 A1	11-01-1980
			NL	7904388 A	18-12-1979
			CA	1120870 A1	30-03-1982
			US	4268279 A	19-05-1981
US 6209855	B1	03-04-2001	WO	0067886 A1	16-11-2000
			EP	1173271 A1	23-01-2002
JP 63258605	A	26-10-1988	JP	2512937 B2	03-07-1996
EP 0732142	A	18-09-1996	EP	0732142 A2	18-09-1996
			JP	8276121 A	22-10-1996
			US	5565149 A	15-10-1996